

Sprouts

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Scientific Name and Introduction: Sprouts are young seedlings just after seed germination. The most common marketed sprout is Mung bean (*Vigna radiata* L. Wilczek; syn., *Phaseolus aureus* Roxb.). Other sprouts include; alfalfa (*Medicago sativa* L.), buckwheat (*Fagopyrum esculentum* Moench), green pea (*Pisum sativum* L.), kidney, pinto, and navy bean (*Phaseolus vulgaris* L.), lentil (*Lens culinaris* Medik.), mustard (*Brassica nigra* L. Koch; *Sinapis alba* L.), onion (*Allium cepa* L.), radish (*Raphanus sativus* L.), red clover (*Trifolium pratense* L.), soybean (*Glycine max* L. Merr.), watercress (*Nasturtium officinale* R.Br.), and Winter cress (*Barbarea vulgaris* R.Br.).

Quality Characteristics and Criteria: Fresh Mung bean sprouts have crisp white hypocotyls and yellow or green cotyledons. Symptoms of deterioration include; darkening of the root and cotyledons, development of dark streaks on the hypocotyl, and eventual development of sliminess, decay, and a musty odor. Other sprouts vary in texture and taste; some are spicy, eg., radish and onion, others are hardy and often used in Asian foods such as Mung bean sprouts, while others are more delicate and used in salads and sandwiches to add texture and moistness, like alfalfa sprouts.

Horticultural Maturity Indices: Sprouts are harvested after 1 to 8 days of growth, depending on the type, and desired plant length and width. For example, Mung bean sprouts are normally harvested after 3 to 8 days when length is 1.3 to 7.6 cm (0.5 to 3 in), while alfalfa sprouts are harvested after 1 to 2 days when length is 2.5 to 3.8 cm (1 to 1.5 in), and radish sprouts after 2 to 4 days when length is 1.3 to 2.5 cm (0.5 to 1 in).

Grades, Sizes and Packaging: There are no established USDA quality standards for sprouts. Perforated film packaging helps maintain the quality of fresh sprouts by reducing water loss. Alfalfa sprouts are marketed in 112 or 168 g (4 or 6 oz) containers with 12 containers per case. Mung bean sprouts are marked in the same size containers and in 2.3 kg (5 lb) open flats.

Pre-cooling Conditions: Sprouts should be cooled immediately and held at 0 °C (32 °F). Vacuum-cooling, hydro-cooling, and forced-air cooling are common methods.

Optimum Storage Conditions: Sprouts are highly perishable and most last 5 to 10 days at 0 °C (32 °F) with 95 to 100% RH. Mung bean sprouts stored at 0, 2.5, 5 or 10 °C (32, 36.5, 41 or 50 °F) reach the lower limit of marketability after 8.5, 5.5, 4.5 and 2.5 days, respectively (Lipton et al., 1981). The shelf-life of bean sprouts held at 0 °C (32 °F), but exposed daily to 20 °C (68 °F) for 30 min can be reduced by 50%. Alfalfa and radish sprouts stored at 0 °C (32 °F) with > 95% RH had a shelf-life of 7, and 5 to 7 days, respectively (Cantwell, 1997).

Controlled Atmosphere Considerations: The shelf-life of Mung bean sprouts can be increased by storage under MA in which O₂ is reduced and CO₂ is increased (Varoquaux et al., 1996). For instance, they can be held for 4 to 5 days at 8 °C (46 °F) in packages containing 5% O₂ + 15% CO₂. Darkening of sprouts is reduced and development of sliminess is delayed.

Retail Outlet Display Considerations: Sprouts should be held close to 0 °C (32 °F). Do not mist.

Chilling Sensitivity: Sprouts are highly perishable and should be stored as cold as possible without freezing. In some cases, the cotyledons of Mung bean sprouts darken more at lower temperatures. However, due to faster deterioration at higher temperatures, storage at 0 °C (32 °F) is recommended.

Ethylene Production and Sensitivity: Sprouts produce little ethylene. Mung bean sprouts produce 0.15, 0.05, 0.24, and 0.90 $\mu\text{L kg}^{-1} \text{ h}^{-1}$ at 0, 2.5, 5, and 10 °C (32, 37, 41 and 50 °F), respectively (Lipton et al., 1981).

Respiration Rates:

Temperature	$\text{mg CO}_2 \text{ kg}^{-1} \text{ h}^{-1}$
0 °C	23
2.5 °C	29
5 °C	42
10 °C	96

To get $\text{mL kg}^{-1} \text{ h}^{-1}$, divide the $\text{mg kg}^{-1} \text{ h}^{-1}$ rate by 2.0 at 0 °C (32 °F), 1.9 at 10 °C (50 °F), and 1.8 at 20 °C (68 °F). To calculate heat production, multiply $\text{mg kg}^{-1} \text{ h}^{-1}$ by 220 to get BTU per ton per day or by 61 to get kcal per metric ton per day. Data are from Lipton et al. (1981).

Physiological Disorders: Mung bean sprout hypocotyls darken with age, becoming beige to light-tan. However, some develop light-tan to rusty-brown streaks, mainly along the lower portion of the axis (Lipton et al., 1981). Such streaks may be present at harvest and are thought to arise from a group of cells that were injured before or during germination. Darkening of the radicles and browning of the cotyledons are other changes associated with the deterioration of Mung bean sprouts. Cotyledon color in Mung bean sprouts may blacken at low temperatures, and this may be a symptom of chilling injury (DeEll et al., 2000).

Postharvest Pathology: Development of decay, sliminess and musty odors are symptoms of deterioration.

Quarantine Issues: None.

Suitability as Fresh-cut Product: No current potential.

Special Considerations: Sprouts have been associated with human pathogenic bacteria, such as *Aeromonas hydrophila*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella* spp., and *Bacillus cereus* (Brackett, 1999). Therefore, the importance of proper storage and handling, along with good worker hygiene and sanitation cannot be stressed enough.

References:

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